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Measuring Child Labor

Comparisons between Hours Data and Subjective Measures

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ABSTRACT

This paper examines a subjective measure of child labor as an alternative to hours data for eliciting the distribution of children's time between work, school, and leisure. The subjective child labor questions that were developed have two primary advantages. First, the subjective measures avoid proxy respondent bias in child labor reports made by parents in a standard hours module. Second, the subjective child labor module scales responses to elicit the relative distribution of the shares of children's time without relying on hours data which are prone to severe outlier problems. Adult, proxy respondents are found to produce uniformly lower reports of children's time allocated to work and school than the child's own subjective responses. Conditional labor supply functions are also estimated to examine the marginal effects of child, parent, household and school characteristics between the two types of data. Children's subjective responses are found to increase the magnitude of the marginal effects for child's age, parental education, and school availability with limited differences between household composition and asset variables.

Keywords: child labor, questionnaire design

1. INTRODUCTION

The welfare implications of child labor depend on the type of work a child undertakes, the age of the children engaging in the work, and the amount of time children participate in work relative to schooling. Without detailed information on the hours of children's activities and children's participation, the magnitudes of household characteristics (assets, parental education, or sibling effects), or the evaluation of a development intervention are masked by the analysis of participation variables that are only partial components of the distribution of children's time. However, increased information about the distribution of children's time comes at the expense of precision because hours data are likely to suffer from measurement error.

In the United States, prominent surveys such as the Panel Survey of Income Dynamics and the Current Population Survey have been subjected to verification surveys to investigate the measurement error in hours data reported in these surveys. Duncan and Hill (1985), Mellow and Sider (1983), and Rodgers, Brown and Duncan (1993) find evidence that measurement error is a significant source of bias in hours data estimates. In agricultural areas where households primarily engage in self-employed activities that do not have finite work schedules, measurement error is likely to be an important source of bias. Because children's hours data are normally reported by proxy respondents, measurement error may, in fact, be a more significant source of bias. It is important to note that, even though hours data are subject to measurement error critiques, bias in continuous dependent variables increases the overall variance of estimates without biasing the parameter estimates (Deaton 1997). From a policy perspective, significant bias in child labor statistics due to measurement error may affect a country's international reputations, give false policy signals and divert attention from countries with more significant child labor problems. In fact, descriptive work that compares estimates of child labor within and between countries finds significant variation among the child labor data available (Guarcello et al. 2008).

This paper examines a subjective measure of child labor as an alternative to hours data for eliciting the distribution of children's time between work, school, and leisure. In a subjective labor module directed to all child respondents aged 10 to 17 within sampled households, an alternative method of collecting information regarding the relative distribution of time was administered. Children were engaged in a game that measured the distribution of the child's time between work, school, and leisure activities by having the child choose 10 cards among three different sets of colored cards to visually represent his or her week.[1] Comparisons between the hours data and these subjective welfare data yield a consistent story with respect to the descriptive patterns of child labor and the magnitudes of time spent in differing activities at the means. The paper also investigates reported hours data for children's activities as well as subjective evaluations of children's work over the previous week to evaluate whether differences in survey design produce different patterns of significance in the covariates.

The organization of this paper is standard. The second section describes the data, specifically the methodology used to collect subjective child labor data. The third section presents the data's descriptive statistics. The fourth section explains the econometric specifications for the conditional labor supply functions to be estimated. The fifth section presents the empirical results and the last section concludes.

[1] Lybbert et al. (2007) use a similar approach to derive the subjective probability distribution of pastoralists' climate forecasts in southern Ethiopia and northern Kenya.

2. DATA DESCRIPTION

The data for this paper were collected as part of the Etude sur la Pauvreté et la Sécurité Alimentaire au Nord Mali 2006 collected by the author.[2] A standard multi-topic household survey was fielded to collect these data, with an additional child labor module to collect information on children's work and schooling activities. The sample of children (1,445 children from 827 households) used in the analysis of this paper are distributed across 5 *cercles*, or states, in northern Mali including the *cercles* of Niafunke, Goundam, Dire, Tombouctou, Rharous, and Bourem. Only households from the household sample who had children aged 10 to 17 with complete and realistic hours reports are included for the purposes of the analysis. The problem of outlier reports is discussed more fully in the next section.

The children's questionnaire module was composed of a series of questions on children's activities (school, farming, working in the family business, household domestic work, providing childcare, and herding livestock) where the parent was first asked about the child's participation in the activity, the number of days the child had engaged in the activity in the previous seven days, and the number of hours that the child had spent in the activity. Next, the subjective questions were administered directly to all children within the household aged 10 to 17 years. In previous work on interviewing children, Borgers, de Leeuw, and Jox (2000) suggest that with 11 to16 year olds an important feature of obtaining reliable survey responses is keeping survey respondents motivated. A face to face interview with visual aids can serve to keep the attention of youth. That recommendation was taken into account in the questionnaire design.

Enumerators were carefully trained to first give the child respondent three stacks of ten different colored pieces of paper.[3] The enumerator explained the question format to each survey respondent. Sufficient time and reflection were permitted before respondents played the game. Respondents were asked to pick 10 total pieces of paper to represent their allocation of time between work, school, and leisure. Each piece of colored paper represented work, school or leisure time. The exact question in English posed to the child is the following:

> *I'd like to do an exercise with you to understand the amount of time you spend in school, work and leisure. Here are three different colored papers. The red papers are representative of time in school. The yellow papers are representative of time doing work to help the family earn money. For example, time when you fish, follow the animals, or work with the family business. The blue papers are representative of leisure time. Now, I would like that you to choose 10 papers of any of the colors that represent your typical day. For example, if you work more than you have leisure time, it is necessary to choose more of the yellow papers than blue papers. If you go to work more than school, it is necessary to choose more of the yellow papers than the red papers. If you have more leisure time than time in school, it is necessary to choose more of the blue papers than the red papers. Do you understand? (If so, give the child the three types of the papers. If not, explain again.)*

Prior to asking this question, the enumerator posed two other questions using the same format. The questions concerned the amount of rice, millet or sorghum that the child had eaten in the last week, and the amount of cereals, meat, and vegetables the child had eaten in the past week. Thetopics were familiar to the child about which they could comfortably and easily answer. The preliminary questions permitted practice with the question format. The "practice" questions also provide a means of verifying whether respondents are consistently choosing the same color or the same number of cards with each response.

[2] A more detailed description of the data set and its sample selection are found in Dillon (2008a).

[3] The author trained all survey enumerators and monitored them throughout the data collection period to ensure compliance and consistency of the research method.

The subjective questions were not designed with the objective of isolating which characteristics might generate tradeoffs among child labor statistics, but to design a subjective child labor question that would be best adapted for child respondents and to compare their responses to a standard set of hours questions administered to adults about their children. This necessitated changes in the recall period, the method of questioning and the respondent between the hours and subjective questions. Using the subjective questions generates an approximate distribution of the shares of children's time between school, work and leisure. The responses to the subjective module are naturally interpreted as deciles of children's time allocated to work, school, or leisure. That is the primary advantage of the subjective questions which focus on the distribution of children's time as the primary object of interest, and by design, avoids outlier reports.

The text of the question does not explicitly list all potential activities, but the example list is meant to highlight activities that children might have forgotten or that might be difficult for them to classify as work, rather than be exhaustive of the activities that should be classified in each response category. In the qualitative work that was conducted before including the question in the survey, children thought of their main activities as agriculture and doing domestic work. This is also reflected in the head of household's classification in the roster section of the survey where the leading activities cited for children aged 10 to 17 were agriculture, going to school and doing artisanal work in the non-domestic activity category, and sweeping the house, fetching water, and preparing food in the domestic activity category.

In the design of this module, a variation in the design of the subjective question could have been to include more cards to increase the level of disaggregation of the time share estimates. However, younger children began to have difficulty in the pre-testing of the question as increased numbers of cards were used. Almost all children could count to 10 easily regardless of education level in the 10 to 17 year old age group. The potential of gaining more detail in the responses was weighed against increasing the difficulty for younger children to respond to the question. Drawing on the small literature that investigates using children as survey respondents, the design of the game was kept simple in an area where low levels of education are prevalent. This ensures that respondents understood the question and had the cognitive skills to map their recollection of their time allocation into the response categories proposed by the question.

3. DESCRIPTIVE STATISTICS

To examine changes in the distribution of children's time across work, schooling and leisure, the hours and subjective questions are compared in Table 1, which presents the unconditional hours and subjective data. According to the hours data, children spend 34.7 hours per week working: 18.4 hours per week, or 53 percent of children's work time, are allocated to domestic work, and 16.36 hours per week, or 47 percent is devoted to market-oriented work. Work constitutes 31 percent of children's time, 59 percent is devoted to leisure, and 10 percent is devoted to school (approximately 11 hours per week). [4] When compared with the subjective child labor questions, the allocation of children's time working is reported to be 47.1 percent.[5] Children's leisure time is reported to be 28.8 percent, and time at school or doing school work 24.1 percent. The reports of children's time allocated to work and school made by adult, proxy respondents are uniformly lower than the children's own subjective responses.

Table 1. Children's Time Allocation: Unconditional Hours by Activity and Cards Reported from Subjective Responses

Hours	**Mean**	**Std. Dev.**
School	11.30	15.24
Farm	8.74	11.94
Family business	7.62	8.90
Chores	13.99	13.57
Child care	4.38	7.75
Market work	16.36	15.14
Domestic work	18.37	16.60
Total work	34.73	23.82
Subjective Measures (Count of Cards)		
School	2.41	3.03
Work	4.71	2.53

Note: Probability weighted means. n = 1,445 children.

Figures 1, 2, and 3 illustrate the distribution of the responses, for work, school, and leisure for the subjective module. The work responses form a bimodal distribution with a lower peak centered around 2 and a higher peak centered around 7 (Figure 1). Perhaps more predictably, the schooling responses also have a bimodal distribution around 0 and 6 which suggests that children either go to school allocating almost 60 percent of their time, or do not go at all (Figure 2). Leisure has a unimodal distribution centered at 2 (Figure 3).

[4] The percentage of children's time devoted to particular activities in this paragraph is calculated from the hours data assuming that the child sleeps eight hours a day and that this time is not included as leisure time. The reason for this is that sleeping time was not included as leisure time in the subjective module. Since the reason we are presenting the hours data is to make some comparison with the subjective results, the methodology to calculate comparable statistics ought to be based on the same fundamental assumptions.

[5] The percentage of children's time allocated to schooling, work, or leisure can be calculated from their mean responses by simply multiplying the response by 10 because the children select 10 differently colored cards to represent their week. Hence, each card represents a decile of time.

Figure 1. Histogram of Children's Work Rankings

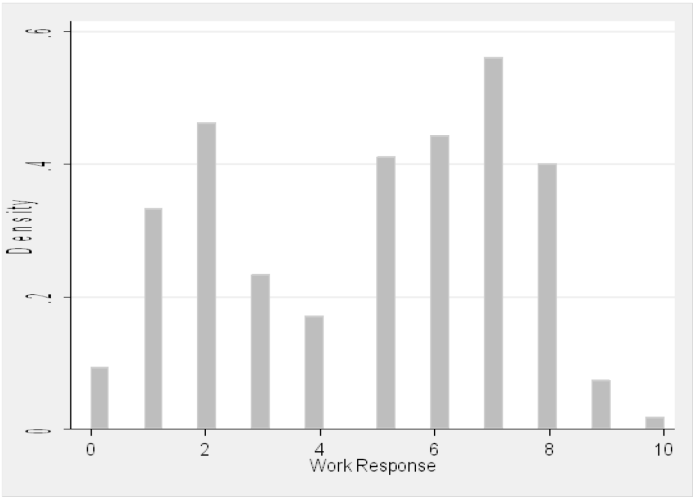


Figure 2. Histogram of Children's School Rankings

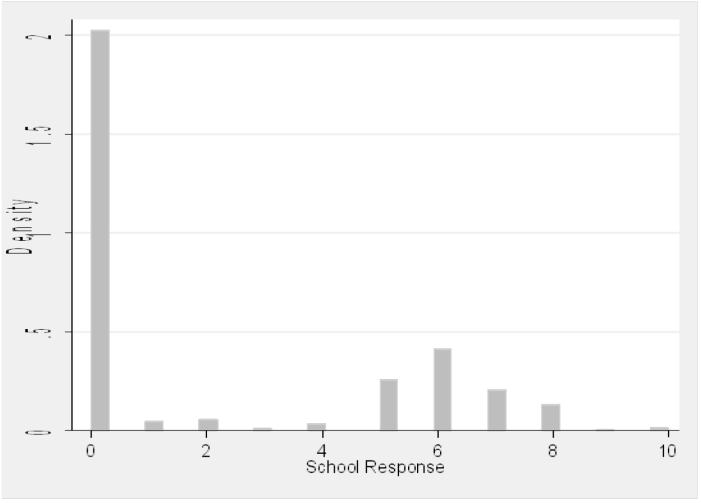
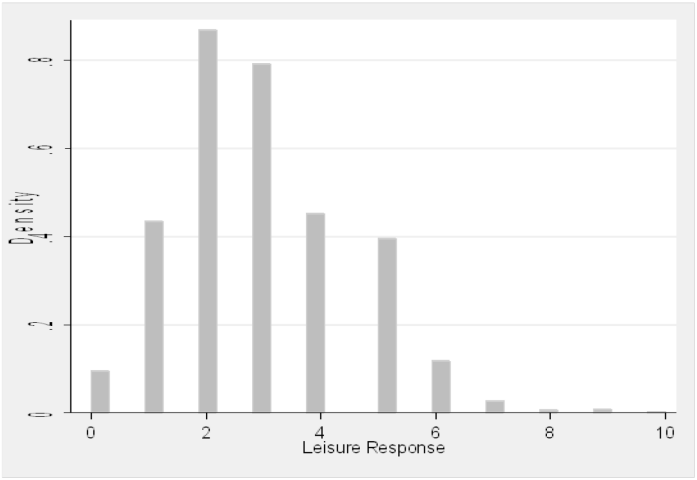


Figure 3. Histogram of Children's Leisure Rankings



The correlation among the same-colored response groups for the work, school, and leisure questions and the two "practice" questions described earlier permit an internal verification of independent response patterns. If previous same-colored responses yield correlated responses in later questions, the independence of a respondent's responses would be questionable. Given that respondents are aged 10 to 17, a skeptic might assert a "favorite color" hypothesis to explain response patterns. However, correlations are low between same colored questions (Table 2). The highest correlations presented in Table 2 exist between yellow responses between sorghum and legume consumptions (0.17). The largest positive correlations between similar colored response categories and the work, school, and leisure categories of interest are work and legumes consumption with a -0.15 correlation[6].

Table 2. Correlations between Color Groups in Questions

	Red Responses		
	Q1-Rice	Q2-Cereal	Q3-School
Q1-Rice	1		
Q2-Cereals	0.126	1	
Q3-School	0.029	-0.105	1
	Yellow Responses		
	Q1-Sorghum	Q2-Legumes	Q3-Work
Q1-Sorghum	1		
Q2-Legumes	0.173	1	
Q3-Work	-0.006	-0.152	1
	Blue Responses		
	Q1-Millet	Q2-Meat	Q3-Leisure
Q1-Millet	1		
Q2-Meat	0.024	1	
Q3-Leisure	0.096	-0.042	1

In further robustness tests on the subjective questions, little evidence is found that the day of the week on which the child was interviewed biases the results. A differences in means test was conducted among the statistics produced for each day of the week in comparison with the statistics for every other day of the week. For the school data, only 4 of the 21 day–of-the-week combinations yielded statistically different estimates. For the work data, only 2 of the 21 day-of-the-week combinations yielded statistically significant differences and only 1 of the 21 day-of-the-week combinations were significant for leisure time.[7] Differences among the statistics are not large. Most of these statistically significant pairs include differences from observations made on Wednesdays, although there does not seem to be a systematic reason why this could be the case. If for example, we found that reports of schooling where much lower on weekend days, when children do not attend school in Mali, this could be indicative of the importance of measuring children's schooling during the week. However, this conclusion is not supported by the data. It is also important to note that the schooling data are bimodal from the descriptive statistics, so we expect that disaggregation of these data would lead to higher proportions of differences between the days of the week independently of the effect of any day-of-the-week bias. The fact that the

[6] These small correlations are not causal evidence of no bias, but rather suggestive that the absence of strong correlations between same-colored response categories which may increase the confidence to readers that children are not picking their favorite color across all three questions. This lends credibility to the internal validity of the question.

[7] These results are omitted for brevity, but are available on request.

incidence of these differences is so low, even in the statistic that is bi-modal, suggests that the day of the week is not significantly biasing the data.

The household and child covariates are described in Table 3. These include the gender of the child, his or her ethnicity, and age dummies. Parental characteristics such as mother's and father's education are presented as indicator variables due to the low level of schooling in northern Mali. Parents' ages are included to capture potential life-cycle effects, while household characteristics including household composition and asset types are also covariates in the conditional labor supply function. Table 4 presents village characteristics including regional dummies, village access to roads, commune population, and villages per commune, which proxy for labor market integration and economic opportunities for adults and children. Table 5 displays school characteristics such as access to primary, secondary and high schools and measures of school quality including the village school's student-teacher ratio, repetition rates, and examination pass rates.

Table 3. Descriptive Statistics: Household and Child Characteristics

	Mean	Std. Err.
Child Characteristics		
Sex (boy = 1)	0.575	0.496
Ethnicity		
Sonrai	0.677	0.472
Tamasheq	0.114	0.377
Peuhl	0.109	0.321
Bambara	0.047	0.247
Other Ethnicity	0.053	0.231
Age Dummies		
Age 10	0.203	0.401
Age 11	0.069	0.275
Age 12	0.140	0.355
Age 13	0.089	0.314
Age 14	0.145	0.349
Age 15	0.127	0.129
Age 16	0.147	0.355
Age 17	0.080	0.265
Adult Characteristics		
Mother's education (1 if any education)	0.048	0.275
Father's education (1 if any education)	0.106	0.367
Age of household head	40.7	23.28
Age of household head's spouse	33.2	14.89
Household Composition		
Own child	0.805	0.402
Number of girls in household	1.359	1.407
Number of boys in household	1.743	1.625
Number of adult women in household	1.685	1.251
Number of adult men in household	1.734	1.507
Household Assets and Unearned Income		
Herd size	20.38	19.54
Herd value (FCFA)	573,832	57,044
Agricultural capital (FCFA)	49,719	12,744
Durables (FCFA)	298,790	69,356
Migrant remittances (FCFA)	57,383	114,356

Notes: All variables are population weighted means. For all children, n = 1,445.

Table 4. Descriptive Statistics: Village Characteristics

Variable	Mean	Std. Dev.
River access	0.331	0.472
Regional Indicators		
Niafunke	0.377	0.486
Goundam	0.166	0.373
Dire	0.159	0.367
Tombouctou	0.099	0.300
Rharous	0.073	0.261
Bourem	0.119	0.325
Kidal	0.007	0.081
Access to Roads		
Road connects with village	0.139	0.347
Within 1–10 km	0.417	0.495
Within 11–20 km	0.232	0.423
More than 20 km	0.212	0.410
Commune Population		
Less than 5,000	0.093	0.291
5,001–10,000	0.225	0.419
10,001–20,000	0.391	0.490
20,001–30,000	0.146	0.354
More than 30,000	0.146	0.354
Villages per Commune		
Less than 10	0.152	0.361
11–20	0.205	0.405
21–30	0.285	0.453
More than 30	0.358	0.481

n = 151 villages.

Table 5. School Characteristics

Variable	Obs.	Mean	Std. Dev.
Primary School Characteristics			
No primary school access	151	0.258	0.439
Primary school in village	151	0.563	0.498
Less than 5 km	151	0.099	0.300
Greater than 5 km	151	0.079	0.271
Multiple primary schools in village	151	0.132	0.395
Student-teacher ratio—primary	107	45.496	20.418
Repetition rate—primary	98	0.305	0.148
Boys' exam pass rate—primary	71	0.651	0.266
Girls' exam pass rate—primary	67	0.590	0.325
Secondary School Characteristics			
Secondary school in village	151	0.159	0.367
High School Characteristics			
High school in village	151	0.026	0.161

Observations are at the village level. For school quality observations, may be less than the number of villages (151) because not all villages have schools and some schools have missing observations for the school quality variables.

Observations were trimmed from the sample due to unrealistic hours reports in excess of 90 hours a week for 358 observations which represents 19.25 percent of the sample. This disadvantage of hours

data is commonly encountered, but may be a more significant source of bias in children's hours reported by parents because of the often unreliability of proxy responses. The advantage of the subjective child labor module is that children's hours are self-reported and scaled to avoid outlier problems by the question design itself.

To investigate the characteristics of the outlier group with the trimmed, retained sample, the differences between the key covariates are presented in Table 6. Differences in the child's gender and the household's livestock holdings between the retained sample and the outliers were statistically different between the subsamples. Girls were over-represented in the outlier group relative to the retained sample. Girls in northern Mali normally engage in a multiplicity of activities in both domestic and market-oriented work which may increase the proportion of unrealistic reports of weekly hours for girls relative to boys. Livestock holdings of the household measured in both value and herd size were greater in the sample retained than in the outliers that were excluded. The luxury axiom (Basu and Van 1998) suggests that greater child labor is associated with household poverty. Excluding unrealistic reports of poorer households could cause underestimates of the importance of child labor in the population of interest. However, measuring household welfare using agricultural capital or household assets yields no statistically significant differences between the retained sample and the outliers. Differences between the retained sample and outliers do suggest that particular attention in future collection of hours data should pay particular attention to girls and poorer households to reduce outlier reports. The next section of the paper focuses on the implications of hours and subjective data for conditional labor supply functions.

Table 6. Differences between Characteristics of Outliers and Retained Sample Observations

	Sample Retained	Outliers	Difference
Boy (1 if yes)	0.576	0.414	0.162***
Age 11	0.069	0.099	-0.030
Age 12	0.140	0.132	0.007
Age 13	0.089	0.080	0.009
Age 14	0.145	0.094	0.051*
Age 15	0.127	0.143	-0.016
Age 16	0.147	0.150	-0.003
Age 17	0.080	0.114	-0.034
Household Composition			
Biological child (1 = yes)	0.805	0.778	0.026
Number of girls	1.4	1.6	-0.3**
Number of boys	1.7	1.6	0.1
Number of adult men	1.7	1.4	0.2**
Number of adult women	1.7	1.6	0.1
Age of head of household	40.6	42.3	-1.8
Age of head of household's spouse	33.3	35.1	-1.9
Household Assets and Unearned Income			
Livestock value (FCFA)	573,867	357,109	216,758***
Herd size (number of animals)	20.4	15.7	4.6**
Agricultural capital (FCFA)	49,719	41,630	8,090
Household durables (FCFA)	298,790	343,906	-45,115
Parental Education			
Any mother's education (1 = yes)	0.048	0.066	-0.018
Any father's education (1 = yes)	0.106	0.084	0.021
School Access			
Primary school in village	0.833	0.779	0.054
Secondary school in village	0.269	0.253	0.016
N	1,445	358	

*** statistically significant at the 1% level; ** statistically significant at the 5% level;
* statistically significant at the 10% level.

4. ECONOMETRIC SPECIFICATION

A large literature on the allocation of children's time in developing countries builds on Beckerian models of human capital investment in children (Becker 1965; Becker and Lewis 1973; Becker and Tomes 1976); agricultural household models developed by Rosenzweig (1977a, 1977b, 1980), Singh, Squire, and Strauss (1986), and de Janvry, Fafchamps, and Sadoulet (1991); and more recent models of child labor by Basu and Van (1998), Basu (1999), Baland and Robinson (2000), Cigno and Rosati (2005), and Edmonds (2007). Variables that are positively associated with children's work from this literature are those that affect the return on children's time in the activity and the opportunity cost of the child's time. Children's time allocation is determined by five sets of observable characteristics (child, adult, household, village, and district characteristics) and a household-level unobservable (household preferences) summarized in the equation to be estimated (equation 1) as follows:

$$T_C^W = T^W(Child, Adult, Household, Village, District, HHpreferences) \quad (1)$$

Child characteristics include the child's age, ethnicity and gender. Adult characteristics include parental ages and education. Durables, livestock values and number of animals, value of agricultural capital, and unearned migrant remittances are the variables employed to characterize the household's assets. Household composition characteristics (the number of adult men, women, girls and boys) are also included as household variables that proxy for total available household labor. These variables are inversely related to children's work time as parent's value children's leisure according to the luxury axiom. Village level variables include such indicators as whether the village has access to roads, school proximity, and school quality—which capture access to school infrastructure. District-level variables which include village population indicators and the density of villages in the district proxy for labor market integration. Seasonal indicator variables are also included in the specification to control for potential variation in labor demand between periods. Regional fixed effects are also included to control for regional characteristics.

To investigate the household's allocation of children's time to work, two econometric specifications using children's hours of work in the past week and the children's own subjective evaluation of their distribution of time are described below. Hours of work and subjective evaluations by the children of the amount of work relative to schooling and leisure will be used to estimate a conditional labor supply function.

Specification 1. Conditional Labor Supply Functions: Controlling for Unobservables

The marginal effects of child-specific (age, gender), parental (age, education), household (assets, unearned income, household composition), village (size, school and road infrastructure), district (population and density), seasonal, and region variables on a conditional child labor supply function are estimated. Conditional labor supply specifications are examined because the allocation of children's time to work depends on both the participation and conditional hours response as described in Heckman's seminal work (1974; 1990). In Dillon (2008b), participation decisions by households in this sample were analyzed to investigate the influence of specific covariates and shocks. For the present purpose of this paper, attention to the conditional hours specification facilitates comparisons between hours data and subjective responses. Using a cross-section of data, a conditional child labor supply function is specified:

$$Hours_{ih} = \beta X_{ih} + \gamma Z_h + \varepsilon_{ih}, \quad (2)$$

where $\varepsilon_{ih} = c_h + v_{ih}$, X_{ih} represents child and parental characteristics for child *i* in household *h*, and Z_h represents village, district and region variables associated with the household.

Household unobservables, c_h, including parental preferences, are likely influences on the allocation of children's time. Ignoring the role of parental preferences or other household-level

unobservables could bias estimates. Since fixed effects capture all time-invariant characteristics of the cross-sectional units, no estimate of the effect of parental education or household assets on child work and school participation would be possible. However, these effects have a documented impact on children's schooling and work (Dumas and Lambert 2004) that cannot be ignored. To control for potential household unobservables, household random effects can identify unobservables across children within households. Additional assumptions with respect to the strict exogeneity of the covariates on children's hours are required and the uncorrelatedness of the household unobservable c_h and child and household characteristics, X_{ih} and Z_h. While these assumptions may be overly restrictive, specifications with and without random effects are estimated as a robustness check.

Specification 2. Ordered Probit Model with Random Effects

An ordered probit model with random effects and without error term assumptions is used to estimate the impact of covariates on the intensity of child work as measured by the subjective child labor module that elicits the distribution of children's work time relative to other activities. Children's responses to the subjective child labor module are recorded as count data between zero and 10. The dependent variable will be the rank that the child puts on the amount of time he or she spends conducting work for the household relative to schooling or leisure.

Let $e \mid x, z \sim Normal(0,1)$. From the subjective child labor module, the threshold parameters are divided into one unit increments such that:

$y=0 \quad if\ y^* \le 1$
$y=1 \quad if\ 1 < y^* \le 2$
$y=2 \quad if\ 2 < y^* \le 3$
$y=3 \quad if\ 3 < y^* \le 4$
$y=4 \quad if\ 4 < y^* \le 5$
$y=5 \quad if\ 5 < y^* \le 6$
$y=6 \quad if\ 6 < y^* \le 7$
$y=7 \quad if\ 7 < y^* \le 8$
$y=8 \quad if\ 8 < y^* \le 9$
$y=9 \quad if\ 9 < y^* \le 10$
$y=10 \quad if\ y^* > 10.$ (3)

Each response probability can be calculated from the conditional distribution of *y* given *x* using the standard normal assumption for the error term[8].

$$P(y=0 \mid X,Z,c)=P(y^* \le \alpha_1 \mid X,Z,c) = P(\beta X + \gamma Z + c + \varepsilon \le \alpha_1 \mid X,Z) = \Phi(\alpha_1 - [\beta X + \gamma Z])$$
$$P(y=1 \mid X,Z,c)=P(\alpha_1 \le y^* \le \alpha_2 \mid X,Z,c) = \Phi(\alpha_2 - [\beta X + \gamma Z]) - \Phi(\alpha_1 - [\beta X + \gamma Z])$$
.
.
$$P(y=9 \mid X,Z,c)=P(\alpha_9 \le y^* \le \alpha_{10} \mid X,Z,c) = \Phi(\alpha_{10} - [\beta X + \gamma Z]) - \Phi(\alpha_9 - [\beta X + \gamma Z])$$
$$P(y=10 \mid X,Z,c)=P(y^* > \alpha_{11} \mid X,Z,c) = 1 - \Phi(\alpha_{11} - [\beta X + \gamma Z]) \quad (4)$$

The log likelihood function that is maximized is formulated:

$$l_i(\alpha,\beta,\gamma) = [y_i = 0]\log(\Phi(\alpha_1 - [\beta X + \gamma Z]) + [y_i = 1]\log(\Phi(\alpha_2 - [\beta X + \gamma Z])$$
$$-\Phi(\alpha_1 - [\beta X + \gamma Z]) + ... + [y_i = 10]\log(\Phi(\alpha_{11} - [\beta X + \gamma Z]) \quad (5)$$

Comparisons between the sign and statistical significance of the key variables of interest follow directly from the estimation of specifications 2 and 5. To compare the magnitudes of the coefficients

[8] Subscripts are suppressed for notational convenience.

between the hours data, which are continuous, and the subjective data estimated with an ordered probit model, the coefficients of the hours data are scaled by the standard deviation of the residual from the hours specification as specified in Cameron and Trivedi (1998). The ordered probit model normalizes the error variance to 1, so that coefficients between the two models are comparable.

Two types of comparisons will be made between the coefficients of interest in the conditional labor supply function. First, the differences between the hours data and the subjective responses can be compared across the ordinary least squares (OLS) specification and the random effects specification that controls for household unobservables. Second, comparisons can be made between hours data and the subjective responses by gender of the child, as pooling the labor supply function may not be the appropriate specification due to gendered perceptions of work or differences in the opportunity costs of boys' and girls' time.

5. EMPIRICAL RESULTS

The results of the estimation of the conditional labor supply function using both hours and the child's subjective evaluation are reported in tables 7 and 8, with special attention given to a select set of covariates frequently investigated in the child labor literature, including children's age and gender, household composition, household assets, parental education, and access to school.

As a robustness check, the results of the estimation of the conditional labor supply function with random effects are compared with the results of the estimates without controlling for household unobservables in Table 7. Children's age indicator variables are presented in Table 7 for ages 15 to17 because the marginal effects are insignificant for younger children. Differences in the magnitudes of these effects are large between the hours data and the subjective data with normalized coefficients. The marginal effect of the child's age on his or her labor supply increases as the child ages. Household composition estimates do not differ greatly between hours and subjective data, but the different types of data do not have the same patterns of statistical significance as the age data. The marginal effects of household assets, measured using both value and number of livestock, agricultural capital, and household durables are also reported in Table 7. The marginal effects of herd size on the subjective data is statistically significant, but small across both the OLS and random effects specifications. Household assets could have greater influence on child labor participation as posited by the luxury axiom, but not necessarily the number of weekly hours in any given task. Parental education and school access are both statistically significant covariates. Parental education has an inverse effect on children's work. Point estimates range between 23 and 24 hours for mother's or father's education indicators in the random effects specification. There is a five hour difference between father's education and mother's education in the subjective data with greater reduction of child labor due to the father's education; however a three hour difference in the OLS estimates suggests a larger effect of mother's education. The random effects specifications both for hours and subjective data suggest a larger or equal effect for father's education. The greatest difference in point estimates exists between the estimates of the marginal effects of school access on child labor hours. In the random effects specification, access to a primary school in the village dramatically lowers the amount of time a child works. This may be because, even with access to a primary school, the returns to education may be low if future schooling is not easily accessible.

Table 8 examines the random effects specifications of the conditional labor supply function estimated with hours data and the subjective responses disaggregated by gender. Age effects are of large magnitude for both genders, but largest for girls as they grow older. The age effects for boys are larger relative to girls when they are younger for the subjective labor data, but continue to increase as the child grows older for the hours data. Household asset variables have stronger effects on boys relative to girls labor supply when disaggregated. Herd size has a significant effect on boys labor supply in both the hours and subjective data, but the marginal effects are small (0.11-0.52). The role of parental education is large for both boys and girls, but the effect of mother's education on boys has a stronger effect than on girls' education. As in the pooled specification, access to school continues to have large negative effects on boys and girls labor supply.

Several factors could explain the discrepancy between hours data and the subjective child labor module estimates in both tables 7 and 8. First, there is a difference between the hours data and the subjective data in respondent, recall period and question type. In general, self-reports are considered more reliable than proxy reports, but little evidence exists on the magnitude of the bias. Parents may not know all the types of work that children do for each different member of the household, especially if the work takes place outside the household, which would lead to the under-reporting of child labor. In this region of Mali, there is no stigma against child labor per se, so this source of potential under-reporting by parents is minimized. Estimates of time working may also be overestimated by children who may dislike work and perceive it to take more of their time. The effects of changes in recall period and question type are harder to assess. Second, the marginal effects of the hours data may be underestimated due to the necessity to trim extreme observations. If outliers are the children that are working the largest numbers of

hours, but grossly over-reporting those hours, then their contribution to the point estimate has been excluded.

This empirical analysis is inherently exploratory as the labor modules have not been randomly assigned to provide unbiased estimates between different questionnaire designs. However, the results are suggestive of directions that future research might take—not only to improve child labor estimates within countries or specific populations of interest, but also to investigate the implications ofdifferent data types in altering point estimates of the determinants of child labor.

Table 7. Labor Supply Functions Estimated with Hours and Subjective Evaluations

Specification	**No Effects**			**Random Effects**		
Outcome Variable		**Subjective**			**Subjective**	
Children's Age Indicators	**Hours**	**Normalized Coefficients**	**Estimated Coefficients**	**Hours**	**Normalized Coefficients**	**Estimated Coefficients**
Age 15	3.75	5.153	0.097	5.846***	14.517	0.275**
	(2.282)		(0.115)	(1.560)		(0.131)
Age 16	6.242***	19.086	0.360***	5.824***	29.615	0.561***
	(2.376)		(0.102)	(1.482)		(0.126)
Age 17	10.68***	24.865	0.469***	8.656***	37.745	0.715***
	(3.232)		(0.141)	(1.782)		(0.153)
Household Composition						
Number of girls	0.839	-1.410	-0.027	0.555	-0.597	-0.011
	(0.725)		(0.037)	(0.583)		(0.041)
Number of boys	-1.760***	-2.158	-0.041	-0.822	-3.247	-0.062*
	(0.639)		(0.027)	(0.521)		(0.034)
Number of adult men	0.666	1.712	0.032	0.378	3.315	0.063
	(0.836)		(0.034)	(0.634)		(0.046)
Number of adult women	-1.137	-1.596	-0.030	-1.628**	-3.088	-0.059
	(0.726)		(0.046)	(0.725)		(0.051)
Household Assets						
Livestock value (in 100,000 FCFA)	-0.238*	0.016	0.000	-0.185	-0.168	-0.003
	(0.142)		(0.008)	(0.136)		(0.010)
Herd size (no. of animals)	0.044	0.232	0.004*	0.036	0.417	0.008**
	(0.057)		(0.003)	(0.052)		(0.004)
Agricultural capital (FCFA)	-0.006	-0.095	-0.002	0.024	-0.051	-0.001
	(0.099)		(0.002)	(0.099)		(0.007)
Household durables (FCFA)	-0.062	-0.426	-0.008*	-0.044	-0.406	-0.008
	(0.119)		(0.004)	(0.099)		(0.007)
Parental Education						
Any mother's education (1 = yes)	-5.833**	-14.208	-0.268	-1.537	-24.494	-0.464**
	(2.245)		(0.208)	(2.896)		(0.208)
Any father's education (1 = yes)	-2.472	-19.828	-0.374***	-4.812**	-23.333	-0.442***
	(2.505)		(0.120)	(2.139)		(0.150)
School Access						
Primary school in village	-3.523	-34.566	-0.652***	-0.719	-32.202	-0.610**
	(5.852)		(0.241)	(4.100)		(0.289)
Secondary school in village	-9.639***	-33.983	-0.641***	-11.68***	-54.057	-1.024***
	(2.634)		(0.108)	(2.295)		(0.165)
Observations	1,445	1,445	1,445	1,445	1,445	1,445

Notes: Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Covariates described above are included in the regression but not displayed for brevity. Normalized coefficients are scaled by the standard deviation of the no effects residual.

Table 8. Gender Disaggregated Results with Hours and Subjective Evaluations

Sample Restriction	Boys			Girls		
Outcome Variable		Subjective			Subjective	
Children's Age Indicators	Hours	Normalized Coefficients	Estimated Coefficients	Hours	Normalized Coefficients	Estimated Coefficients
Age 15	5.702***	11.628	0.218	6.927**	9.773	0.183
	(2.079)		(0.179)	(2.772)		(0.231)
Age 16	5.486***	33.924	0.636***	6.853***	28.732	0.538**
	(2.127)		(0.186)	(2.469)		(0.209)
Age 17	8.686***	26.616	0.499**	9.061***	47.797	0.895***
	(2.455)		(0.216)	(3.096)		(0.273)
Household Composition						
Number of girls	0.551	3.264	0.061	1.613*	-2.371	-0.044
	(0.736)		(0.055)	(0.860)		(0.064)
Number of boys	-0.869	-2.240	-0.042	-0.48	-4.700	-0.088
	(0.653)		(0.045)	(0.738)		(0.055)
Number of adult men	0.503	4.134	0.078	0.901	3.589	0.067
	(0.733)		(0.054)	(0.886)		(0.066)
Number of adult women	-1.781*	-5.707	-0.107	-1.860*	-1.170	-0.022
	(0.921)		(0.069)	(0.963)		(0.071)
Household Assets and Unearned Income						
Livestock value (FCFA)	-0.502***	-0.603	-0.011	-0.028	-0.135	-0.003
	(0.158)		(0.012)	(0.168)		(0.013)
Herd size (no. of animals)	0.111*	0.524	0.010**	0.013	0.314	0.006
	(0.061)		(0.005)	(0.068)		(0.005)
Agricultural capital (FCFA)	0.0243	-0.078	-0.001	0.118	0.099	0.002
	(0.103)		(0.008)	(0.124)		(0.009)
Household durables (FCFA)	-0.246*	-0.470	-0.009	-0.017	-0.285	-0.005
	(0.138)		(0.010)	(0.121)		(0.009)
Parental Education						
Any mother's education (1 = yes)	1.724	-36.857	-0.691***	-3.189	-16.662	-0.312
	(3.519)		(0.265)	(3.803)		(0.281)
Any father's education (1 = yes)	-4.101	-17.122	-0.321	-6.106**	-35.567	-0.666***
	(2.632)		(0.195)	(2.832)		(0.213)
School Access						
Primary school in village	3.809	-30.510	-0.572	-2.303	-32.790	-0.614
	(4.975)		(0.371)	(5.921)		(0.440)
Secondary school in village	-12.71***	-55.899	-1.048***	-9.893***	-56.555	-1.059***
	(2.687)		(0.207)	(3.388)		(0.261)
Observations	820	820	820	625	625	625

Notes: Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
All specifications include random effects to control for household unobservables. Covariates described above are included in the regression but not displayed for brevity. Normalized coefficients are scaled by the standard deviation of the random effects residual.

CONCLUSION

This paper examines a subjective measure of child labor as an alternative to hours data for eliciting the distribution of children's time between work, school, and leisure. The subjective child labor module has two primary advantages: first, it avoids proxy respondent bias in child labor reports made by parents; and second, the subjective child labor module scales responses to elicit the relative distribution of children's time without relying on hours data that may be prone to severe outlier problems in hours reports. Adult, proxy respondents are found to have uniformly lower reports of children's time allocated to work and school than the child's own subjective responses. Hours data remain a richer source of information on the distribution of children's time, but concerns about measurement error in their collection may off-set that advantage in some contexts. In northern Mali, self-employed farmers have malleable schedules that do not facilitate easy recall of hours spent over the standard seven day reference period.

To make valid comparisons between hours data and subjective measures of children's work, the marginal effects of child, parental, household and school characteristics were compared between the hours data and subjective data specifications under two different sets of assumptions about the specification of the conditional labor supply function. In the first set of specifications, household unobservables were included as a component of the error term. This random effects specification was compared with the OLS estimates, which ignore the role of household unobservables. In the second set of specifications, the assumption of pooling both girls and boys in the same labor supply function was relaxed. After these robustness checks, a consistent pattern in the data emerged. Children's subjective responses are found to increase the magnitude of the marginal effects for child's age, parental education, and school availability with limited differences between household composition and asset variables.

Differences between these two types of data should not be interpreted as causal, but as exploratory and suggestive of biases that could exist with different methods of data collection. The differences have certain policy implications for the monitoring and evaluation of child labor reduction efforts by countries and nongovernmental organizations. More research into the effects of different methods of data collection for child labor is necessary, given the widespread variation of child labor statistics reported across different surveys in the same countries (Guarcello et al. 2008). To provide consistent estimates of child labor, researchers in the fields of psychology, statistics, and economics are needed to increase the quality of labor statistics reported for children.

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